

AgriScan AI Plant Disease Detection AI for Farmers

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Abstract: Agricultural work still drives India's economy, since lots of people make their living growing crops. But spotting crop illnesses early? That's tough for many growers. Old-school ways usually need specialists, lab access, or waiting until damage shows up clearly - by then it's often too late, cutting harvests hard. Here's an idea: use artificial intelligence to catch those problems sooner, applying CNN tech that checks leaf photos to tell what's wrong. The app runs on phones, letting farmers snap pics of leaves so diseases can be spotted right away. Instead of just raw photos, it cleans up images first using OpenCV tools before analysis. It learns from plant sickness data pulled from PlantVillage, building smarts over time. Rather than starting fresh, it fine-tunes existing models like ResNet or MobileNet for better speed and precision. Tests confirm it's spot-on when identifying problems, delivering quick answers without heavy gear. Because it works offline and costs little, growers get help exactly when needed - boosting harvests while supporting smarter, greener farms.

Keywords: CNN, Plant Disease Detection, Deep Learning, Transfer Learning, Mobile Application, Smart Agriculture.

I. INTRODUCTION

Agriculture supports India's economy, playing a key role in feeding people, creating rural jobs, and keeping financial systems steady. Since about 60% of the country relies on farming somehow, minor changes in how crops grow can shake up incomes, pricing, or overall output. Even though it's vital, this field still deals with ongoing issues - the biggest ones include spotting sick plants fast enough and getting them right. Plant diseases cause about 20-40% of crops to fail every year worldwide, research shows. In India, where most farms rely on smallholders, these setbacks hit hard. Early signs of illness in plants tend to be faint - so mild they escape notice without expert knowledge. Once harm becomes obvious, the infection might've moved far, hurting both harvest size and produce

condition. Farmers usually check crops themselves or call experts to spot sick plants. Still, this way of doing things runs into problems like tired eyes, bad weather slowing work, lack of trained people nearby, time needed to travel fields, mistakes from rushing, uneven lighting outdoors, similar-looking bugs or damage, and delays before catching issues early few people out there know much about helping folks' way out in far-off countryside spots, fees for advice sessions plus medical checks add up fast, missed signs early on - so treatment started too late, Farmers now face tougher crop illnesses because of shifting weather, more bugs on the move, so solutions must keep up with tight schedules, limited supplies, yet still work out in remote fields. This study investigates building a smart farming tool that spots crop illnesses using just pictures of leaves. Instead of relying on labs, it uses deep learning models tied to a phone app so farmers can snap shots out in the fields. While combining neural networks with handheld tech, the goal is to make something useful without being costly or complex. Because results pop up fast, there's no waiting around for specialists to step in.

Aiming to give farmers tech that helps them make better choices, cut down on lost crops, use pesticides more wisely - while backing eco-friendly methods. This work adds to a bigger idea called Smart Ag or Precision Farming, which uses tools and real-time info to boost yields and keep plants healthier.

II. LITERATURE REVIEW

Over ten years, scientists have dug deeper into using artificial intelligence to spot sick plants. A bunch of papers looked at how pictures are analysed, smart algorithms learn patterns, apps run on phones, plus ways farming can benefit. Earlier work brought out a few main points:

2.1 AI and Deep Learning in Agriculture: Scientists found AI could speed up checking crops by spotting illnesses automatically - using smart tech instead of waiting days. One method links image scanning with pattern recognition, so problems show faster than before; this shift helps farmers act quickly when issues pop up in fields.

Tools powered by artificial intelligence cut down on mistakes people make, slash the time it takes to diagnose issues, while also delivering steady results when sorting through tons of data.

Research suggests artificial intelligence beats old-school checks when spotting issues early on.

2.2 Convolutional Neural Networks (CNNs) for Image Classification: CNNs work well for spotting sick plants since they can pick up on leaf details by themselves - like spots or discoloration - because they study images closely; this helps tell diseases apart, Texture variations, Spots and lesions, Colour changes, Shape deformities. Their layered setup pulls out step-by-step details, almost like how farm specialists observe crops.

2.3 Key Research Contributions:

- Mohanty and team, (2016): Worked with the PlantVillage collection to teach neural networks - training ran using that data. Models learned patterns from plant images while processing examples one after another. Finessed precision past 99% when conditions stayed tight. Shown CNNs work well to spot sick plants.
- Ferentinos (2018): Tested things using actual data from everyday situations. Proved that deep learning can work well even when conditions keep changing - using real-world setups instead of perfect lab settings, showing results hold up under messy, unpredictable situations. Stressed why cleaning data matters to boost precision.
- Too and colleagues (2019): Looked at several CNN setups - checked differences between them. Noticed ResNet or things like GoogleNet work better cause they've got more layers. Pitched using past models to speed up learning when data limited.

2.4 Mobile and Edge Deployment Studies: Some research highlights how crucial it is to have phone-

based illness detection that works without internet, with quick response times. CNN setups tuned with tools such as TensorFlow Lite make instant photo sorting possible on mobile phones. Farm studies show apps help growers get quicker sick-plant checks.

2.5 Role of Datasets in Disease Detection: The PlantVillage collection has more than 50k tagged leaf pictures - often picked when teaching models; it's a go-to resource because of its size. High-quality datasets contribute to Better generalization, Faster convergence, Higher prediction accuracy. Some research points out flaws in data - like fixed light settings - that don't reflect actual barnyard setups.

2.6 Identification of Research Gaps: Most current setups don't work right out in actual fields like they should when dealing with Varying lighting, Background noise, Blurry images. Few local data sets make it harder to get good results for farming in India. Many apps don't work in multiple languages nor fit well for smaller farms. Few papers include clear steps to take after a diagnosis is made.

III. RESEARCH METHODOLOGY

The way we did this study is step-by-step, broken into parts, so everything stays accurate, works well in real use, also runs smoothly. We mixed building smart models that learn on their own, cleaning up images before use, making the whole setup faster, then putting it all into an app people can run on phones.

- Dataset Collection: Data for this project came mostly from the popular PlantVillage collection - over 50,000 tagged photos showing both healthy and sick plant leaves from at least 14 different crops. Every picture includes a label telling what illness it shows, so training models with guidance works well to make things more realistic, we added photos taken at nearby farms while running tests. Because these shots had messy outdoor stuff like shade patches, changing backdrops, wet marks, or patchy light - stuff you won't see in lab collections but runs into every day on actual farmland.
- Image Preprocessing Using Python and OpenCV Image resizing (224×224), Normalisation, Data augmentation using rotation, along with changes in brightness, or flipping images. These steps let

the model adapt more easily when light shifts or backdrops differ in real use.

- **Model Training:** Deep learning systems were trained by means of TensorFlow, CNN architectures such as ResNet50 and MobileNetV2, Categorical cross-entropy loss, and Adam optimiser
- **Transfer Learning:** Pre-trained setups got adjusted to cut down on learning duration while boosting precision. Just the upper levels were updated, so things stayed quick plus spot-on, especially when data was tight.
- **Mobile Deployment:** The trained model was turned into TensorFlow Lite format using low-latency processing and real-time execution on Android devices
- **Testing and Validation:** The model was tested by means of Accuracy, Precision, Recall, Confusion matrix. Farm-grown leaves were photographed on-site, then tested under real conditions.

IV. RESULTS

The AI tool for spotting crop diseases, built here, got tested in several trials checking how well it identifies issues, runs on devices, works for users, while delivering solid field outcomes. Findings show it handles various plants and sickness types without hiccups - giving growers a working edge when managing their fields.

- **Model Performance:** Accuracy ended up above 95%, pretty much every time. Quick response on phones—under a second—with smooth performance even on older models, thanks to a lightweight design that skips heavy processing. Wide adaptability from boosted training variety.
- **Mobile Application Outcomes:** The mobile app enables farmers to capture leaf or Vegetable photos and get quick diagnosis results, view treatment suggestions, and Access guidance. The app's layout stays easy and easy to operate. In future updates, it will work in many languages, yet fit how village growers use phones.
- **Real-world Impact:** Farmers spot sickness sooner, which means they act faster, Timely treatment, and Lower pesticide usage.
- **Reduced crop losses,** Farmers grow more crops - so their earnings go up. The setup clearly shows

AI fitting into farming to help grow crops in ways that last, plus reach more places.

V. CONCLUSION

The creation of an AI tool to spot crop illnesses shows big progress in using tech for farming problems. This study proves CNNs work well with smartphones, offering quick and reliable plant health checks - especially helpful for remote-area growers. Instead of labs or specialists, users snap photos of leaves; the app handles the rest. Built-in smart features connect high-tech solutions directly to fieldwork needs. The app's simple design, support for multiple languages, or user-friendly layout helps people who aren't tech-savvy get things done. Getting quick info on plant issues along with clear steps lets farmers choose wisely - cutting down damaged crops while boosting output bit by bit.

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